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Sensible Things that Communicate

PART OF MID SWEDEN UNIVERSITY

The Sampling Pattern Cube: A Framework for Representation and Evaluation of Plenoptic Capturing Systems

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Abstract:

Digital cameras have already entered our everyday life. Rapid technological advances have made it easier and cheaper to develop new cameras with unconventional structures. The plenoptic camera is one of the new devices which can capture the light information, which is then able to be processed for applications such as focus adjustments. The high level camera properties, such as the spatial or angular resolution are required to evaluate and compare plenoptic cameras. With complex camera structures that introduce trade-offs between various high level camera properties, it is no longer straightforward to describe and extract these properties. Proper models, methods and metrics with the desired level of details are beneficial to describe and evaluate plenoptic camera properties.

This thesis attempts to describe and evaluate camera properties using a model based representation of plenoptic capturing systems in favour of a unified language. The main outcomes of the thesis can be summarized in the following points: A model based representation of the light sampling behaviour of the plenoptic capturing system is introduced (the SPC model), which incorporates the focus information as well as the ray information. A framework is developed to generate the SPC model and to extract high level properties of the plenoptic capturing system. Results confirm that the SPC model is capable of describing the light sampling behaviour of the capturing system, and that the SPC framework is capable of extracting high level camera properties with a higher descriptive level as compared to the ray-based model. The results from the proposed model compete with those from the more elaborate wave optics model in the ranges that wave nature of the light is not dominant. The outcome of the thesis can benefit design, evaluation and comparison of the complex capturing systems.